

**SRB**

**STS-103 (B1099)  
FLIGHT READINESS REVIEW**

**Program**

**November 19, 1999**

**SOLID ROCKET BOOSTER**

## AGENDA

Presenter:

Roger Elliott

Organization/Date:

USA/11-19-99

- STS-93 Postflight Assessment
  - RH Tilt Hydraulic Pressure Measurement IFA
- Certification Status - No Issues
- Configuration Summary
  - Four RH EDAS and LH/RH ET Camera Configuration
- Special Topics
  - BSM Liner Soft Spot
  - Hydraulic Pump Torsion Spring
- Readiness Assessment

# STS-93 INFLIGHT ANOMALY

Presenter:

Roger Elliott

Organization/Date:

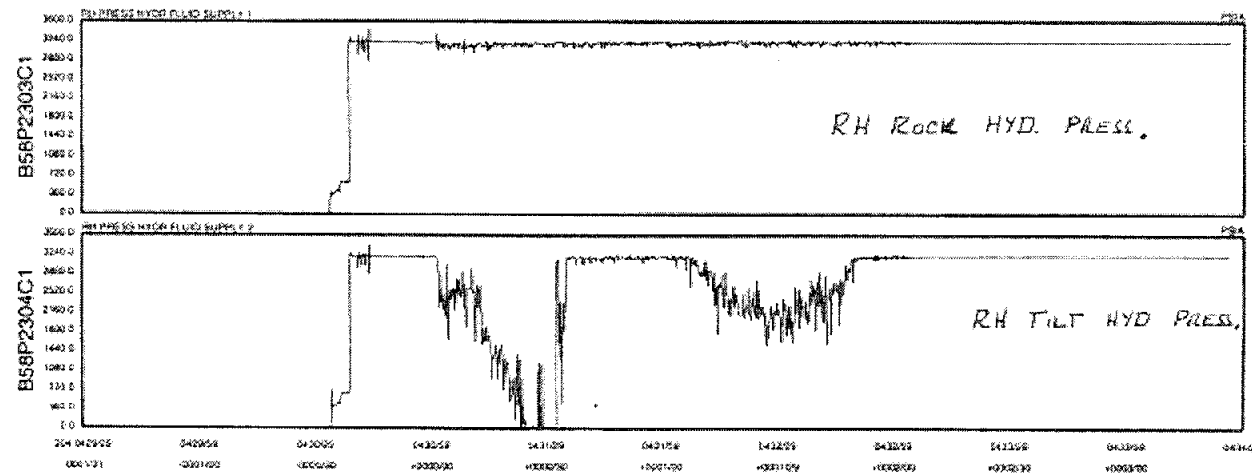
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## Anomaly

- RH TVC tilt hydraulic pressure measurement became erratic during ascent

## Discussion

- Pressure measurement provides data during T-17 seconds to T-10 seconds for launch commit
- Worst case impact is launch scrub (Criticality 3)



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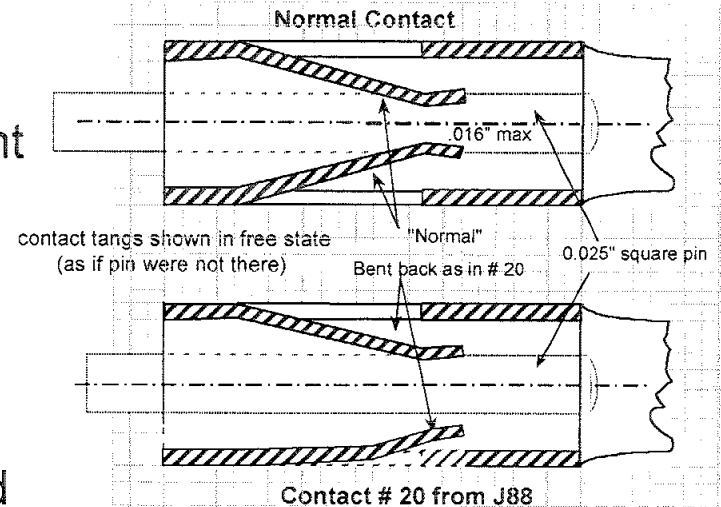
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## Investigation

- Failure was not repeated
  - Pressure transducer vibrated at flight levels (sixteen additional missions)
  - Watertight reusable cable X13W3R visually inspected and electrically tested
  - Aft skirt throwaway cable X02W11 visually inspected, electrically tested and subjected to destructive failure analysis
  - Aft IEA S/N 61 visually inspected, recertification tested, and vibration tested
- MDM static testing complete (no anomalies)
- Amplifier Buffer Attenuator (ABA) card testing completed (no anomalies)
- Internal inspection of IEA found one ABA card edge connector contact damaged



## STS-93 INFLIGHT ANOMALY

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### Investigation (cont.)

- Intermittent open circuit on this contact would cause observed anomalous condition (failure mode validated with circuit analysis)
- Isolated case - 1,485 contacts inspected
- This type of contact only used in Criticality 3 circuits
- IFA to be closed as an unexplained anomaly; most probable cause is damaged ABA connector contact

### Corrective Actions

- Improved connector/contact visual inspection for these IEA signal conditioner connectors
- Visual inspection to be performed prior to reinstalling replaceable units into these connectors each time

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## STS-93 INFLIGHT ANOMALY

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### Rationale for Flight

- Isolated case (first occurrence)
- This connector contact type is restricted to data circuits (Criticality 3 measurements)
- No effect on TVC system control during flight
- Not a flight safety concern

# SPECIAL TOPIC - BSM LINER SOFT SPOTS

Presenter:

Roger Elliott

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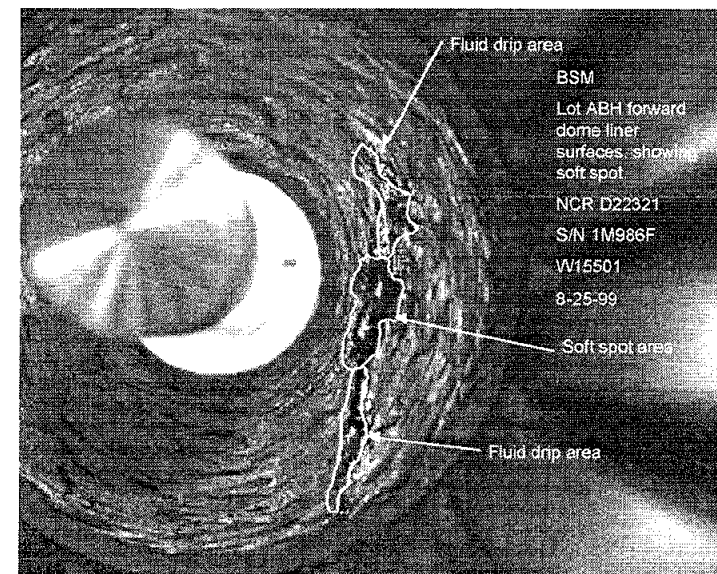
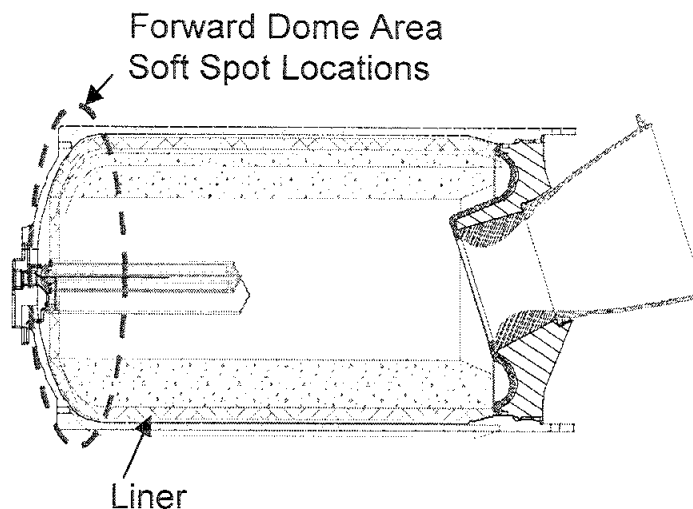
## Issue

- Liner soft spots observed in the BSM forward dome and case wall liners during production of Lots ABG, ABH and ABJ

## Concern

- Forward dome burn through and/or propellant debris

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## **SPECIAL TOPIC - BSM LINER SOFT SPOTS**

Presenter:  
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### Discussion/Background

- Total of 180 BSMs in Lots ABG, ABH and ABJ
- Seven motors had one soft spot each
  - Lot ABG (1); Lot ABH (2); Lot ABJ (4)
  - One Lot ABH BSM propellant machined out of case and one soft spot identified in liner on case wall
- No history of anomaly prior to Lot ABG
- BSMs installed on STS-103 from different lots (ABC, ABD and ABE)

# **SPECIAL TOPIC - BSM LINER SOFT SPOTS**

Presenter:  
Roger Elliott

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USA/11-19-99

## Investigation

- Investigation and testing identified root cause of soft liner to be the liner mixer in Station 250
  - Mixer rotation not in correct direction
  - Wiper blade is installed upside down not properly wiping the bowl wall
  - Mixer was only used by CSD for liner Lots ABG, ABH and ABJ
  - Uncured liner material taken from mixer side wall shows Lots ABG, ABH and ABJ produced material below specification
- BSM production Lots ABF and earlier were produced with Station 20 mixer

## **SPECIAL TOPIC - BSM LINER SOFT SPOTS**

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### Corrective Action

- Detailed review and update of liner process floor paper conducted
- Lots ABG, ABH and ABJ have been placed in bonded storage

### Rationale for Flight

- STS-103 BSMs not affected; BSMs processed with different mixer, which was properly configured, and produced to specification liner material

## SPECIAL TOPIC - HYDRAULIC PUMP TORSION SPRING

Presenter:  
Roger Elliott

Organization/Date:  
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### Issue

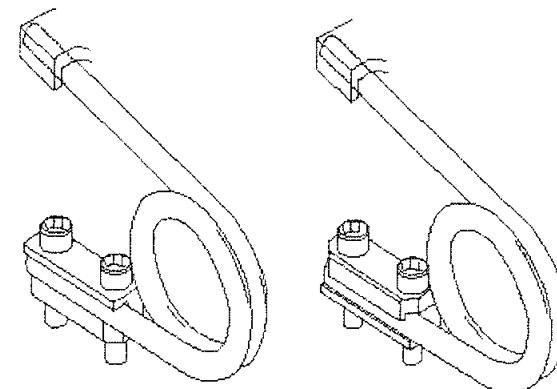
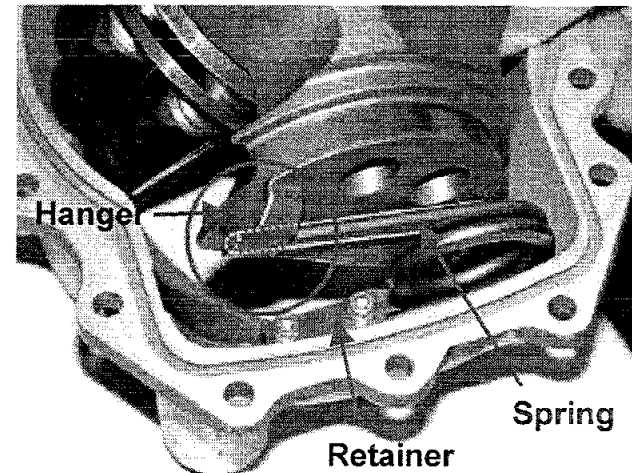
- Orbiter found Hydraulic Pump torsion spring not properly seated in hanger

### Concern

- Could cause erratic discharge pressure or loss of hydraulic system function

### Discussion

- Orbiter pump flew in this configuration on STS-89 (pump functioned nominally)



Correct

Incorrect

Retainer Configurations

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## **SPECIAL TOPIC - HYDRAULIC PUMP TORSION SPRING**

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### Discussion (cont.)

- Radiographic Inspection (RT) found to be excellent method to determine if springs are in hangers
- SRB found one pump in stores with both springs out of hangers
- Analysis shows 1900+ g's required to lift spring out of hanger
- RT of STS-103 orbiter and SRB hydraulic pumps performed (springs installed in hangers)
- Retainers used to secure torsion spring to pump housing not installed per drawing
  - Vendor testing verifies pump performance nominal with retainer installed in either configuration

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## **SPECIAL TOPIC - HYDRAULIC PUMP TORSION SPRING**

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### Corrective Action

- Verification techniques of proper installation after vendor refurbishment under evaluation
- Vendor engineering change in work to allow observed retainer configuration as alternate

### Rationale for Flight

- RT verification of proper torsion spring/hanger installation
- Analysis shows spring will stay captured in hanger and can not "jump" out
- Either orientation of spring retainer is acceptable
- No impact to system function or flight safety

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# READINESS ASSESSMENT

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Pending completion of open work, there are no constraints for flight for STS-103

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